

**Amendments to the Claims:**

The listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. **(currently amended)** An engine control system for a combustion engine, comprising:

a NOx trap catalyst provided in [[the]] an exhaust pipe of said engine to trap NOx by absorption or storage in an oxidation atmosphere and emit NOx in a reduction atmosphere;

a NOx sensor located in the downstream of said NOx trap catalyst to detect an amount of NOx ~~components~~ in exhaust;

a NOx trap catalyst model for estimating a NOx amount trapped in said NOx trap catalyst; [[and]]

a device that ~~controls the operating condition~~ starts a rich spike control of said engine based on ~~outputs of the~~ the NOx amount estimated by said NOx trap catalyst model ~~and said NOx sensor; and~~

a tuning device that tunes a parameter of said NOx trap catalyst model based on the output of the NOx sensor while the engine is in operation.

**2. (currently amended)** The engine control system according to Claim 1, wherein said NOx trap catalyst model estimates [[a]] the NOx amount trapped in said NOx trap catalyst and [[a]] an NOx amount in the downstream of said NOx trap catalyst based on exhaust components and an air flow rate.

**3. (currently amended)** ~~The engine control system according to Claim 1,~~  
An engine control system for a combustion engine, comprising:

a NOx trap catalyst provided in the exhaust pipe of said engine to trap NOx by absorption or storage in an oxidation atmosphere and emit NOx in a reduction atmosphere;

a NOx sensor located in the downstream of said NOx trap catalyst to detect NOx components in exhaust;

a NOx trap catalyst model for estimating a NOx amount trapped in said NOx trap catalyst; and

a device that controls the operating condition of said engine based on outputs of said NOx trap catalyst model and said NOx sensor,

wherein said NOx trap catalyst model comprises:

a means for obtaining the air-fuel ratio and the intake air flow rate of said engine directly or indirectly;

a means for obtaining the predetermined NOx density in the upstream side of said NOx trap catalyst based on the operating condition of said engine;

a means for obtaining the NOx amount flowing into said NOx trap catalyst

from said NOx density and said intake air flow rate;

a means for obtaining the predetermined NOx trap ratio based on said air-fuel ratio and said intake air flow rate;

a means for obtaining the NOx trap speed from said NOx amount inflowing into said NOx trap catalyst and said NOx trap ratio;

a means for obtaining the predetermined NOx release speed in said NOx trap catalyst based on said air-fuel ratio and said intake air flow rate; and

a means for estimating the NOx trap amount based on the difference between said NOx trap speed and NOx release speed.

**4. (original)** The engine control system according to Claim 3, wherein said NOx trap catalyst model replaces said NOx trap ratio with a new NOx trap ratio based on a correction coefficient obtained from the estimated NOx trap amount.

**5. (original)** The engine control system according to Claim 4, wherein the newly obtained NOx trap ratio is corrected according to the output from said NOx sensor located in the downstream of said NOx trap catalyst.

**6. (currently amended)** The engine control system according to Claim 3, it is equipped with a tuning device that tunes on-line the NOx trap ratio obtained at said NOx trap catalyst model based on the output of the NOx sensor ~~by using online~~.

7. **(original)** The engine control system according to Claim 1, wherein a rich spike control is started when the NOx trap amount in said NOx trap catalyst, which is computed by said NOx trap catalyst model, or the output of said NOx sensor exceeds a specified value.

8. **(original)** The engine control system according to Claim 1, wherein the rich amount or rich time required for said rich spike is determined based on the NOx trap amount in said NOx trap catalyst estimated by said NOx trap catalyst model.

9. **(original)** The engine control system according to Claim 3, wherein the NOx trap ratio is corrected based on the NOx amount detected in the downstream side of said NOx trap catalyst during the rich spike of said engine.

10. **(original)** The engine control system according to Claim 6, wherein the NOx trap ratio representing a NOx trap capacity is provided in said NOx trap catalyst model, and said tuning device adjusts the NOx trap ratio in said model based on the estimated NOx trap amount.

11. **(new)** The engine control system according to Claim 1, wherein the NOx trap catalyst model estimates the NOx amount trapped in said NOx trap

catalyst during lean-burn operation, and the tuning device tunes the parameter of said NOx trap catalyst model during a rich spike of said engine.

**12. (new)** The engine control system according to Claim 11, wherein the tuning device computes a NOx amount trapped in the NOx trap catalyst in the lean operation based on the output of the NOx sensor using a map during the rich spike after the lean operation, and tunes the parameter of said NOx trap catalyst model based on a result of comparing the NOx amount estimated by the NOx trap catalyst model and the NOx amount computed by the map.